

September 7, 2008

From the Los Angeles Times

Alan Zarembo

Article courtesy of Tosh Ushino, UCLA, who comments "Another story on CT scans":

http://www.latimes.com/news/science/la-sci-ctscan7-2008sep07_0,5239630,full.story

CT SCANS CAN BE BETTER MEDICINE FOR DOCTORS THAN FOR PATIENTS

They provide detailed views of internal organs, but the price is increased doses of radiation. When Maureen Scanlan had a painful kidney stone episode four years ago, she was pleased that her doctor ordered an annual regimen of CT scans to monitor her condition.

The scans involved hundreds of razor-thin X-rays of her innards stitched together by a computer into stunningly detailed 3-D images showing the size and location of the stone, down to the millimeter.

What she didn't realize was that the perfection of the images was a result of a radiation dose equivalent to more than a dozen standard abdominal X-rays -- all for a condition that though painful is relatively mundane.

"I never thought twice about it," said the 38-year-old mother of two from Westfield, N.J., who since learning of the radiation has been worried that the scans may have played a role in two miscarriages. "I knew there was radiation, but I didn't realize how strong it was."

Scanlan is part of an explosion in the use of one of the most revolutionary medical technologies of the last half century.

Introduced in the 1970s, computed tomography scans have become a standard procedure for such common problems as kidney stones, persistent headaches and appendicitis.

Doctors in the U.S. ordered 68.7 million CT scans last year, more than triple the number in 1995, according to IMV Medical Information Division, a medical market research group in Des Plaines, Ill.

Generating tens of billions of dollars in billing each year, CT scanning has become an economic engine for hospitals and doctors, and the once-exotic million-dollar devices are starting to be found in private practices.

"It's gotten into the culture of doctors," said Geoffrey Rubin, a Stanford University radiologist.

But with the boom has come a rising concern that the abundant use of radiation is beginning to have a subtle effect on the health of the nation.

Although the risk of a single CT scan to an individual is minuscule, even a tiny increase in radiation exposure spread over a large population can eventually add up to tens of thousands of cancer deaths a year.

A controversial study published last November in the New England Journal of Medicine estimated that CT scans administered today could cause up to 2% of cancer deaths in two or three decades.

The doctors who have embraced the technology in increasing numbers say the small increased risk is a minor price for a snapshot of the body so detailed it can delineate hidden infections of the sinuses, tiny blood clots in the lungs and thin layers of plaque on heart vessels.

"The problem is they are almost too good," said UCLA radiologist Dr. Jonathan Goldin. "People want to take a picture of everything just in case."

Some researchers estimate that up to a third of scans could have been avoided or replaced by safer technologies, such as ultrasound or magnetic resonance imaging.

"In 20 or 30 years, the radiation debate will be like the smoking debate today," Goldin said. "People will say, 'Why did I get this imaging in the first place?' "

Private scanners

In the basement of a Beverly Hills office building, Dr. Hooman Madyoon peered into a computer screen displaying a pristine black-and-white image of a heart caught mid-beat.

Rotating the picture, he zoomed in on an artery and traced its gnarly path in increments of less than half a millimeter.

Through a radiation-proof window in the next room, the machine, an upright doughnut with a table positioned in the center, was being prepared for the next patient.

"It's just a matter of time before this catches on everywhere," said Madyoon, whose practice has done about 8,500 scans since installing the \$1.2-million machine four years ago.

The images are created using a revolving X-ray beam that clicks on for a few seconds, scanning the human body slice-by-slice as if it were a loaf of bread.

The scans can cost from a few hundred dollars for a single organ to a few thousand dollars for a full-body image.

Since the first CT scanner in the United States was purchased in 1973 by the Mayo Clinic in Rochester, Minn., the U.S. total has grown to 24,000 machines.

That amounts to 81 CT scanners in the U.S. for every million people -- almost three times the average for the rest of the industrialized world, according to a 2007 report from the McKinsey Global Institute, an economic research group. Only Japan has a higher density of machines at 93 per million people.

About 70% of the scanners are in hospitals. But with declining prices, a growing number are being installed in private practices and imaging centers.

Today, scanner manufacturers, including Siemens and General Electric Co., tout the ease of making money with the devices. Just two scans a day can pay for a machine and its operation over a five-year period, according to a Siemens sales brochure. Ten scans a day can bring in more than \$400,000 a year in profit.

For diagnosis, CT can offer huge advantages over its main competitor, MRI, which avoids radiation but costs more and requires the patient to lie in a clanging cylinder for half an hour or longer.

CT scanners have made exponential jumps in speed over the years, allowing them to freeze the subtle motions of the gut and the heaving of the lungs. Modern scanners are fast enough to capture a snapshot of a beating heart.

Today, CT scans of nearly every body part are increasing swiftly as doctors have embraced the technology to conduct virtual colonoscopies, lung cancer screenings, blood vessel inspections and a host of other procedures.

"Talking about reducing the number of scans is like trying to stop the future," said Dr. Daniel Rosenthal, a professor of radiology at Harvard Medical School. "The equipment and images are so much better that it is pointless to try and stop it."

Cancer risk

Every so often, scientists believe, a CT scan unleashes the following chain of events:

Radiation knocks loose an electron from an atom, creating an ion that damages a cell's DNA.

Although the damage is not big enough to kill the cell, it is too big to repair. Over the next two or three decades, the cell divides and multiplies, spreading the faulty genetic instructions.

The result is cancer.

The increased risk varies with age but, at most, adds about a tenth of a percent to a person's 42% lifetime chance of getting cancer.

Still, even the small amount of radiation from a CT can compound over time as the number of scans adds up.

Scientists measure effective radiation doses using millisieverts, which represent the amount and type of radiation a person receives as well as the sensitivity of various organs.

Most CT scans deliver an effective dose of 5 to 25 millisieverts. That is below the U.S. occupational limit of 50 millisieverts a year but well above the exposure limit for the public of 1 millisievert per year.

Both figures purposely exclude background radiation from natural sources as well as medical radiation, which is deemed necessary and thus unavoidable.

But although individual doctors may believe ordering a scan is justified, they often have no idea how many scans a patient has already had. The numbers can quickly slip out of control, repeatedly exposing patients to added radiation.

Dr. Thomas Dehn, chief medical officer for National Imaging Associates Inc., which manages health plans for private insurers, reviewed more than 800,000 imaging claims over a four-year period and found 11,535 patients who had received more than 50 millisieverts, mostly from CT scans.

Of those patients, 107 had each received more than 200 millisieverts, including one who got 992 millisieverts.

"The patients should be asking the physicians, 'Should I be getting this exam?' " Dehn said.

The number of multiple scans is growing. A study by the Government Accountability Office on the rising cost of medical imaging found that patients who got a CT scan averaged 2.5 scans in 2006, up from 2.1 in 2000.

Scanner manufacturers have responded to rising concerns about radiation by improving their machines, allowing operators to select the lowest dosage necessary to get a useful image.

Still, CT scans have become the primary driver of the nation's rising radiation exposure.

Between 1980 and 2006, the dose per person from medical testing more than quintupled from 0.55 millisieverts to an estimated 3 millisieverts a year.

Medical tests are now the biggest source of radiation exposure, recently surpassing background radiation, according to the National Council on Radiation Protection & Measurements.

Of particular concern is the rising use of CT scans for children and pregnant women. Children -- who account for 11% of CT scans -- face significantly higher risks than adults because they are more sensitive to radiation and have more years ahead for a cancer to develop.

For example, an abdominal scan in a 5-year-old carries a 0.10% risk of triggering a fatal cancer, nearly 10 times the risk in adults older than 35, according to the New England Journal study.

Risks this small are not well understood, and there is a vigorous debate over what they mean.

The best data on low-level radiation exposure come from studies of about 25,000 survivors from two or three miles outside the blast zone of the Hiroshima and Nagasaki atomic bombs at the end of World War II. They received between 5 and 150 millisieverts -- equivalent of a few CT scans -- and had small but statistically significant increases in cancer and death rates, according to studies.

The National Academy of Sciences weighed in on the issue in a 2006 report, saying that there is no safe level of radiation exposure and that even small doses pose some health risks.

But Cynthia McCollough, a medical physicist who oversees the Mayo Clinic's 23 CT scanners, said data on the long-term effects of low-level radiation are still too limited.

No one is certain if there is a minimum threshold of radiation exposure that must be reached before it becomes dangerous, she said.

At less than a long-term cumulative dose of 100 millisieverts, "you get more into religion than science," she said.

New questions

As long as a scan is medically necessary, the benefit "in practically all cases outweighs the small risk in the future," said John Boice, a radiation expert who is the scientific director of the International Epidemiology Institute in Rockville, Md.

But studies over the last few years have begun to question whether all the scans are actually needed.

In 2000, when the number of scans was half of today's total, Highmark Blue Cross Blue Shield of Pennsylvania reviewed 162,000 claims for CT scans and other

imaging procedures and deemed at least 30% either inappropriate or not contributing any useful information.

Even some routine uses have been called into question. For example, one study found that a radiation-free ultrasound may be just as good as a CT scan at diagnosing appendicitis in children. Other research found that in children with chronic headaches, a normal neurological examination made scanning unnecessary.

Doctors concede that the realities of modern medicine -- a complex mix of business, law and expediency -- have exerted a subtle pressure that pushes up the number of scans.

In a 2003 survey of 824 doctors published in the Journal of the American Medical Assn., more than half of the emergency room doctors, orthopedic surgeons and neurosurgeons said they ordered CT scans and other imaging tests just to protect themselves from lawsuits.

"Patients come in with a headache," said Dr. Scott Lederhaus, a neurosurgeon in Pomona. "If they don't get scanned and something gets missed, they can sue."

"If they are persistent about it, I will just order a scan," he said. "I don't care. It's just not worth the aggravation."

As medicine has become less profitable, CT scanners have also become a potential source of income, allowing doctors to offer additional services they can bill for instead of referring patients elsewhere.

There is a natural inclination for doctors to use machines they've bought or have some financial stake in. Studies have shown that doctors with their own equipment are two to seven times more likely to order tests than those who send their patients to other facilities. A recent report by the Government Accounting Office suggested that financial incentives for doctors were a major factor in the rising number of scans.

Madyoon, whose cardiology practice was among the first in California to get a CT scanner, said the main reason to have one is for the convenience of patients.

But since doctors have been suffering as "the dollars and cents are being squeezed out of medical practice, why shouldn't they get their own equipment?" Madyoon asked. "You've got to survive."

A cornerstone of his practice is a controversial type of heart scan known as a CT angiogram, which provides a high-resolution image of coronary arteries using a blast of radiation roughly equivalent to 100 standard chest X-rays.

The scans are much simpler to do than traditional angiograms, which require threading a catheter into arteries, but they are also less accurate.

In just four years since the scans became possible, the number has quickly climbed past 400,000 a year in the U.S.

Although research suggests the scans can rule out heart disease in certain patients, Medicare earlier this year found evidence that the scans improved overall cardiac care to be inconclusive. Cardiologists and radiologists launched a massive protest when Medicare attempted to eliminate most reimbursement, enlisting members of Congress in a successful fight to ensure that government kept paying.

Medicare is now debating how far to go in restricting doctors from referring scanning business to themselves, in part to rein in skyrocketing scanning costs, which have grown to \$2.17 billion in 2006, more than double what Medicare paid six years earlier.

Starting next year, it plans to eliminate a common arrangement in which doctors lease blocks of time on somebody else's machine and bill as if they own the equipment.

A bigger fight is brewing over the potential conflict of interest for doctors who own their own machines. It pits cardiologists, orthopedic surgeons and other specialty doctors against radiologists, who rely solely on referrals for their business and resent the invasion of their turf.

So far, the government's most significant response to the scanning boom has been to reduce the reimbursements for a variety of medical scans, including CTs.

Undeterred, doctors simply ordered more scans.

The momentum to scan keeps building, and even patients clamor for the procedure regardless of whether they have to pay themselves.

Madyoon figured that out of the 6,000 heart scans his practice has conducted, about a quarter have been on middle-aged patients with no symptoms of heart trouble -- a situation not covered by Medicare or private insurers.

The American College of Cardiology and the Society of Cardiovascular Computed Tomography do not recommend scans for people who show no symptoms of heart disease.

In those patients, there is little evidence that a scan leads to any better care than a physical exam, cholesterol test, a walk on a treadmill and a few questions about family history, diet and tobacco use.

But Madyoon believes scientific data will eventually show that screening saves lives. He called the radiation risk a "nonissue" because patients tend to be in their 50s and older, and the scans don't have to be repeated for several years.

"This test is powerful," he said. "We're diagnosing hidden disease."

Patients haven't complained, he said.

Ali Nader, a 46-year-old attorney in Beverly Hills, didn't have any symptoms of heart trouble, but at a funeral for yet another relative who died of a heart attack, a cousin told him about a new type of scanner that could see into his coronary arteries.

He and his brother decided to visit Madyoon in June for scans. The total bill was \$3,000 -- a \$500 discount. Their arteries were fine.

"I have more peace of mind than before," Nader said.

He plans to repeat the scan once a year just to make sure.

alan.zarembo@latimes.com